

This guide takes the requirements for a Preliminary Engineering Report from the rules of the Vermont Water Supply Division and supplements them with additional guidance from the Rural Development Bulletin for a Preliminary Engineering Report for a water system. This guide follows the format of the rules of the Water Supply Division.

## 1.2 Engineer's Report

A Preliminary Engineering Report should clearly describe the owner's present situation, analyze alternatives, and propose a specific course of action, from an engineering perspective. The actual content of the report, the level of effort required to prepare the report and the depth of analysis within the report are determined by the size and complexity of the proposed project. This guide describes the information that may be necessary in a Preliminary Engineering Report. Reviewing agencies will require that all applicable issues identified in the guide be addressed. The layout of the guide is one possible format. Other formats that contain this information are possible and acceptable.

The proposed project needs to be cost-effective, to be technically feasible, to reflect the capabilities and desires of the system's owners, and to be constructed and operated in an environmentally responsible manner. The following is a guide for the preparation of Preliminary Engineering Reports for water systems financed by any of the following agencies, either alone or in any combination:

- Vermont Department of Environmental Conservation
- Vermont Community Development Program's Community Development Block Grants
- USDA Rural Utilities Service

The Engineer's Report for waterworks improvement shall, where pertinent, present the following information.

### 1.2.1 General Information shall include the following.

- (a) name and mailing address of the owner or official custodian;
- (b) identification of the area to be served on a Vermont orthophoto base tax map;
- (c) general description of any existing water works or drinking water facilities, including age, general condition, and adequacy;
  - 1. Describe suitability for continued use. Also, describe compliance with Safe Drinking Water Act and applicable State requirements.
  - 2. Provide a schematic layout and general service area map (may be identified on project planning area maps).
  - 3. Provide information regarding current rate schedules and a tabulation of users by billing usage categories. Provide annual operating and maintenance cost (O&M) and revenue received for the last three fiscal years. Give status of existing debts and reserve accounts.
  - 4. Describe the need for the project in the following order of priority:
    - Health and Safety. Describe concerns and include relevant regulations and correspondence from/to Federal, and State regulatory agencies.
    - System O&M. Describe the concerns and indicate those with the greatest impact. Investigate water loss, management adequacy, inefficient designs, and problem elimination prior to adding additional capacity.
    - Describe the reasonable growth capacity that is necessary to meet needs during the planning period. Facilities proposed to be constructed to meet future growth needs should generally be supported by additional revenues. Consideration should be given to

designing for phased capacity increases. Provide number of new customers committed to this project.

(d) a letter of allocation from the **Public** water system serving the project, or source approval following part 3 of this appendix; and

(e) information on fire protection to be provided, if any.

#### 1.2.2 Extent of Water Works System, including:

(a) description of the nature and extent of the area to be served;

Maps, photographs, and sketches should indicate legal and natural boundaries, major obstacles, elevations, etc.

Environmental resources present. Describe the environmental resources in the project planning area. Include maps, photographs, studies and narrative. These materials should provide information on the location and significance of important land resources (farmland, forest land, wetlands and 100/500 year floodplains, including stream crossings), historic sites, endangered species/critical habitats, hazardous waste sites, and other environmental resources that must be considered in project planning. Also include documentation of any preliminary environmental public notices.

(b) provisions for extending the water works system to include areas beyond limits of intended construction; and

(c) appraisal of the future requirements for service, including existing and potential industrial, commercial, institutional, and other water supply needs.

Specific areas of concentrated growth should be identified. Population projections for the project planning area and concentrated growth areas should be provided for the project design period. These projections should be based on historical records with justification from recognized sources.

1.2.3 Alternate Plans. Where two or more feasible solutions exist for providing **Public** water supply facilities, including connection to an existing **Public** water supply, the applicant shall discuss the alternative plans. Reasons shall be given for selecting the one recommended, including financial considerations, implementability and a comparison of the minimum level of certification a water works operator needs to have to operate each alternative facility.

(a) Describe the facilities associated with the alternative. Describe all feasible water supply sources and provide comparison of such sources. Also, describe treatment, storage and distribution facilities.

(b) State the design parameters used for evaluation purposes. These parameters must follow the criteria established in RUS Instruction 1780.

(c) Provide a map or schematic layout.

(d) Environmental impacts. Describe how the alternative affects the environmental resources that are present in the project area. Describe any steps taken to avoid, minimize, and mitigate any potential effects caused by the alternative.

(e) Cost Estimates.

Construction.

Non-Construction and Other Projects.

Annual Operation and Maintenance.

Present Worth, based on Federal discount rates.

(f) Advantages/Disadvantages. Describe the specific alternative's ability to meet the owner's needs within its financial and operational resources, comply with regulatory requirements, compatibility with existing comprehensive area-wide development plans, and satisfy public and environmental concerns. A matrix rating system could be useful in displaying the information.

1.2.4 Design Criteria. A summary of complete design criteria shall be submitted for the proposed project containing, but not limited to, the following:

For water supply, include requirements for quality and quantity.

(a) safe yield of the source of supply (which may be waived for existing systems with no history of outages and which will not allow further connections);

(b) reservoir surface area, volume, and a volume-versus-depth curve, if applicable;

(c) area and map of source protection area;

(d) estimated average and maximum day water demands for the design period;

(e) number of existing and proposed services;

(f) fire fighting requirements; includes volume (gpm), pressure and duration of flow (minimum of 2 hours required);

For treatment, describe the process in detail and identify the location of the plant and the site of any process discharges.

(g) flash mix, flocculation and settling basin capacities;

(h) retention times;

(i) unit loading;

(j) filter area and the proposed filtration rate;

(k) backwash rate; and

(l) feeder capacities and ranges.

For storage, identify size, type and site location.

For pumping stations, identify size, type, site location and any special power requirements.

For the distribution layout, identify general location of line improvements: lengths, sizes and key components.

1.2.5 Soil and Groundwater Conditions, including a description of:

(a) the character of the soil through which water mains are to be laid;

(b) soil conditions prevailing at sites of proposed structures;

- (c) the elevation of highest groundwater in relation to subsurface structures.
- (d) other concerns such as limited access, hazardous substances, or other conditions which may affect cost of construction or operation of facility.

1.2.6 Water Use Data to include:

- (a) a description of the population trends as indicated by available records, and the estimated population which will be served by the proposed water supply system or expanded system;
- (b) present water consumption and the projected average and maximum daily demand, including fire flow demand (see Subpart 1.2.8); and
- (c) unusual occurrences, including anticipated future industrial or commercial uses.

1.2.7 Hydraulic Analysis. A hydraulic analysis shall be performed on all proposed water systems, and may be required on major improvements to existing systems, demonstrating the ability of the system to meet pressure and flow requirements.

The submittal should include a map with a list of nodes and pipes and the associated characteristics, such as elevation of node, pipe diameter, pipe segment length, reservoir elevation, domestic and industrial water demands, fire flow, etc.

1.2.8 Fire Flow Requirements to include:

- (a) requirements of the Insurance Services Office, current edition or the local fire department as to fire flows required in the service area involved; systems used for both fire protection and domestic use must maintain a minimum of 20 psi under fire flow conditions at all points in the distribution system and provide adequate distribution storage to meet both domestic and fire flow requirements (See Subpart 7.0.1).
- (b) fire flows which will be made available by the proposed or enlarged system; and
- (c) information of type and connection to the water system required for building sprinkler systems, including back flow prevention devices meeting the applicable ASSE Standards and AWWA Standard M - 14.

1.2.9 Describe the existing sewerage system and indicate location of existing and known future sewage treatment works, with special reference to their proximity or to existing or proposed water works structures which may affect the operation of the water supply system, or which may affect the quality of the supply.

1.2.10 Source of Water Supply. Describe the proposed source or sources of water supply to be developed, the reasons for their selection and provide information as needed to gain source approval as required in Subpart 3.0. (Provide details of operation when two or more sources are used)

1.2.11 Proposed Treatment Processes. Summarize and establish the adequacy of proposed processes and unit parameters for the treatment of the specific water under construction. Alternative methods of water treatment and chemical use should be considered as a means of reducing water handling and disposal problems. Pilot studies are required when the proposed treatment deviates from the conventional complete treatment involving coagulation, flocculation, sedimentation and filtration with standard rates. Pilot studies may range from review of pilot studies on similar systems with similar raw water quality to full scale pilot system construction and evaluation.

1.2.12 Waste Disposal. Discuss the various wastes from the water treatment plant, their volume, proposed treatment and points of discharge. Disposal of water treatment plant sludge shall occur in a manner that is in accordance with the Agency of Natural Resources requirements.

1.2.13 Automation. Provide data supporting the selection of automatic equipment, for treatment plants, including the servicing and operator training to be provided. Manual override must be provided for any automatic controls.

1.2.14 Project Sites to include:

(a) discussion of the various sites considered and advantages of the recommended one(s).

(b) the proximity of residences, industries, and other important establishments and land uses *[this might only apply to the recommended alternative.]*

(c) discussion of easements required.

(d) specify whether these properties and easements are currently owned, to be acquired or leased.

1.2.14 (c) any potential sources of contamination that may influence the quality of the supply or interfere with effective operation of the water works system, such as sewage absorption systems, septic tanks, privies, cesspools, sink holes, sanitary landfills, refuse, garbage or industrial dumps, etc.

1.2.15 Financing to include:

(a) estimated cost of integral parts of the system

Provide an itemized estimate of the project cost based on the anticipated period of construction. Include development and construction, land and rights, legal, engineering, interest, equipment, contingencies, refinancing, and other costs associated with the proposed project. (For projects containing both water and waste disposal systems, provide a separate cost estimate for each system.)

(b) projected estimated annual cost of operation

1. Income. Provide a rate schedule. Project income realistically, based on user billings, water treatment contracts, and other sources of incomes. In the absence of other reliable information, for budget purposes, base water use on 60 gallons per capita per day, or 150 gallons per residential-sized connection per day, or 4,500 gallons per residential-sized connection per month. When large agricultural or commercial users are projected, the report should include facts to substantiate such projections and evaluate the impact of such users on the economic viability of the project. The number of users should be based on equivalent dwelling units, which is the level of service provided to a typical rural residential dwelling.

2. Operations and Maintenance Costs. Project costs realistically. In the absence of other reliable data, base on actual costs of other existing facilities of similar size and complexity. Include facts in the report to substantiate operation and maintenance cost estimates. Include salaries, wages, taxes, accounting and auditing fees, legal fees, interest, utilities, gasoline, oil and fuel, insurance, repairs and maintenance, supplies, chemicals, office supplies and printing, and miscellaneous. Also include the cost to purchase water or the cost of treating water by others.

3. Capital Improvements. This includes any sinking fund or any capital improvement program in use by the applicant.

(c) proposed methods to finance both capital and operating costs.  
At least one scenario involving RUS funding shall be for loan only. Other scenarios may involve loans and grants based on discussions with RUS.

1.2.16 Future Extensions. Summarize planning for future needs and services.

1.2.17 Conclusions and Recommendations. Provide any findings and recommendations that should be considered in development of the project. These may include:  
recommendations for special studies  
identification of the need for special coordination  
a recommended plan of action to expedite project development, etc.